



**Tofte Ranger District
Superior National Forest**

September 2011

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“The Facilitated Learning Analysis process helps us to maximize learning opportunities presented by unintended outcomes or near miss events. The intent is to improve performance by generating individual, unit, and organizational learning that capitalizes on shared experience—blaming is replaced by learning.”

**Facilitated Learning Analysis
Implementation Guide
August 2010**

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1. Accident Summary

On September 19, 2011, two U.S. Forest Service employees and two bulldozers/operators are operating in tandem on a fire line. The terrain where they are building fireline is broken and rocky and moves through uplands and swamps and is surrounded by shallow rooted tree species. The visibility along this line is limited due to the large amount of herbaceous vegetation in the understory. The afternoon is clear and sunny.

At 1540 the dozer bosses (DB1 and DB2) and dozer operators (DO1 and DO2) stop to restock and confer about the operations for the rest of the day. The meeting breaks up and DO1 moves to the lead dozer (D1) and DB2 walks back down the line to talk to TFLD (t). DB1 and DO2 continue to converse about their operations.

As DO1 begins to move and back up, the back left corner of the dozer hits two small snags, which began to fall. DB1 yells and waves at DO1, who does not immediately notice DB1. As the snags start to fall, DB1 yells at DO2 to run. As they turn to run back down the trail away from the falling snag, the snag falls on the head and back of DO2, knocking him down.

DO1 is flagged down by DB1 and stops all operations. The tree is removed from DO2; DO2 remains in the position of his accident until EMT arrives.

DIVS (T) was contacted and the Accident Communication Procedure was initiated. DIVS(T) then

- Contacted Air Attack (AA) who relayed message to ICP.
- Contacted EMT and proceeded to accident scene,
- Requested ambulance to be directed to evacuation location,
- Requested that documentation process begins,

Action is supported by Law enforcement who provides direction to Ambulance and provides traffic control in and out of scene.

The EMT arrives at the dozer line and is escorted into that accident scene by an extra crew member sent to provide direction to folks coming in. EMT arrives at the accident and assesses DO2's condition and determines that an injury to the left leg has occurred. This leg is put into a splint, and after additional evaluation, and at his insistence DO2 drives the dozer (D2) out to the ambulance location.

After the ambulance left, the employer of the Dozer operator arrived on the scene and discussed the situation with the Safety Officers and DIVS, collected the information he needed and left the scene.

No other injuries or damage occurs from the accident.

2. Facilitated Learning Analysis Process

The Forest Supervisor requested the Incident Management Team to complete an evaluation of the accident. Agreeing to this request, the IC had the Safety Officer assemble a team which included two members of the team and a line officer from the host Forest to conduct a Facilitated Learning Analysis.

The primary objective of such an analysis is to determine factors which contributed to the accident and any measures which could be taken to prevent a recurrence. A secondary objective is to develop a report which clearly identifies what occurred and shares recommendations for reducing the likelihood of a recurrence.

This report will be disseminated to provide opportunities for local, regional and national learning to occur. It will be posted on the Lessons Learned website (see adjacent text box).

Facilitated Learning Analysis History and Intent

In 2006, in an effort to help encourage a learning culture and a safety culture within the wildland fire community, the Forest Service Risk Management Council introduces a learning-focused approach into the accident investigation process. In 2007, the Council formalizes this concept with two new safety analysis processes: The “Facilitated Learning Analysis” (FLA) and the “Accident Prevention Analysis” (APA). Since then, numerous FLAs and APAs have been conducted throughout the country on incidents that range from vehicle and equipment turnovers to entrapments and shelter deployments.

When used as intended, the APA and FLA will promote a learning culture and support organizational and individual performance, leadership, accountability, and responsibility. Concurrently, the FLA and APA analyses also serve to support program goals for developing a fundamentally sound and doctrine-based organizational safety culture.

The implementation guides for conducting both an FLA and an APA are available on the Wildland Fire Lessons Learned Center’s web site at:

http://wildfirelessons.net/documents/Organizational_Learning_APA_FLG_Guides_2010.pdf.

Snag vs. Human Accident Facilitated Learning Analysis Team

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3. Accident Background

Conditions at Accident Site

Line Construction using bulldozers presents numerous hazards. Several hazards were identified during operations when this accident occurred. They included:

- ❖ Hilly and rocky terrain.
- ❖ Large numbers of shallow rooted trees (live and dead) with damage to root systems.
- ❖ Poor visibility due to terrain and vegetation.

The width of the dozer line was approximately 14 feet wide, but was very rough and rocky and the terrain made travel difficult.

Sunny conditions prevailed and visibility was good. However, due to the terrain and rocky conditions, vegetation, and the type of burning activity in this area, the fire line was not straight and reduced straight line sight distance.

Because of the dangerous conditions and the nature of the operations, regular briefings were held, outlining the hazards on the line and the best way to mitigate these hazards for crews that might follow behind line construction operations. All of the fire line personnel were wearing appropriate PPE.

Dozer Bosses and Dozer Operators

At approximately 1540 (8 hours into a 12 hour shift), the lead dozer boss (DB1) and dozer operator (DO1) stop short of a 90 degree jog in the line, angling the dozer 45 degrees away from the line, with two jack pine snags in the left rear blind spot of the dozer (See Photo 1).

DB1, DB2 and DO1 have a conversation until DO2 arrives, after a couple of minutes, DO2, parks his dozer at the base of the hill and joins the other three. Both DBs and DO's indicate this was the closest all of them had been to each other through the entire shift.



Photo 1: Close-up of snags and the D1 after the accident. Note the rocks, difficult terrain, vegetation, and the blind spots in the enclosed cab of D1.

After a short conference and restocking of flagging and other supplies, the group concludes the brief discussion and prepare to move on with the line construction. DB2 leaves the site to meet TFLD (t). DO1 re-enters his machine and begins positioning his dozer to continue. DB1 and DO2 are still talking at the meeting site, approximately 60 feet away. As DO1 began moving his machine, DB1 watches operations from



Photo 2. Picture of the hill slope where the accident occurred looking down from the right angle corner in the fireline. Note the dead tree in the fireline that struck D2. The dozer is moving back out to the road.

behind the dozer. After shifting the direction of his dozer, DO1 shifted to reverse...at this time DB1 began to see the snags adjacent to the dozer move and starts shouting and waving at DO1 (they had no radio contact). The snags started to fall. Seeing that he could not get the attention of DO1, DB1 shouts at DO2 to 'run', both turn to run. DB1 was able to avoid the falling snags, DO2 was not. A 5" DBH tree fell across the head and back of DO2 knocks him to the ground and breaks both ear muffs off of his hardhat. The tree hit his hardhat.

4. Accident Chronology

Snag vs. Human Accident Chronology September 19, 2011

- ❖ **1540**--DB1 needs supplies, calls DB2, who was between DO1 and DO2. DB2 stops DO1. Stops beyond the top of a right angle jog in the line (See photo 3).
- ❖ DB2 and DO1 meet at the top of the rise between two right angles and begin to discuss operations for the rest of the day. DB1, who is ahead of D1 by 200-300 feet joins them.
- ❖ A couple of minutes later, DO2 arrives at the bottom of the slope approximately 100 feet away, stops his dozer, and walks up to join the meeting.

- ❖ DB1, DB2, DO1 and DO2 discuss operations for the rest of the day. Conversation wraps up and DB2 leaves the site to meet TFLD(t), DO1 returns to his dozer, DB1 and DO2 remain at the site and watch DO1. (photo 3).
- ❖ DO1 begins to back up his machine. As soon as the back-up alarm goes off, DB1, recognizing that the roots of two snags adjacent to DO1 have been cut off and are in danger of falling, takes a step towards DO1 and begins waving trying to get his attention to stop, this is unsuccessful. DO1 hits the snags and they begin to fall. DB1 turns and yells at DO2 to run. They turn to run and the smaller snag hits DO2 in the head and back while running away (photos 2 and 3). DB1 gets DO1 attention to stop after DO1 has positioned the dozer for a 90 degree angle in the line.
- ❖ **1543** -- DIVS (T) receives call that an injury has occurred. DIVS (T) contacts Air Attack on A/G who uses Forest Net (local repeater) to contact the ICP. Actions as follow performed by DIVS(T):



- DIVS (T) uses Tac to contact EMT1, hooks up together, and proceeds to accident site.
 - DIVS (T) calls for an ambulance to be located at a location close to exit point, where they can be waiting when the injured party arrives
 - DIVS (T) contacts ground resources to begin documentation.
 - DIVS (T) arrives with EMT at the Dozer line leading into the accident, where a crew member from a nearby crew was waiting to take them to the accident site.
- ❖ **1612**--EMT arrives on accident scene and assesses the patient. Patient has never lost consciousness, vitals are stable and strong. Patient has identified that he is feeling pain in his leg...cannot walk. EMT stabilizes the leg and begins discussing options for evacuation.
- ❖ **1630**--Decision is made to have DO2 drive his dozer off the line (He was determined to bring the Dozer off the line). DIVS (T) and EMT discuss this situation, and EMT determines that there is no health/safety reason not to allow D2 to drive the machine out. The decision is made to allow DO2 to drive out. (This decision reduced exposure of risk...carrying DO2 out on a back board would have been extremely difficult; the fire line is rocky, uneven, and has extremely poor footing).
- ❖ **1725**--DO2 drives machine out to where the ambulance is located and is loaded into the ambulance and taken to the hospital.
- ❖ **1730**--Owner arrives on scene and collects necessary information for insurance purposes.

5. Key Analysis Observations and Learning Elements

Analysis of Factors Associated with the Accident

The dozer bosses and dozer operators had been operating in a safe manner. All required PPE had been utilized. Equipment had maintained the required spacing necessary for safe operations. This meeting was the only time during the day on the line when DB1 and DB2 and DO1 and DO2 had been that close. Dozers were not equipped with radios, so voice and hand signals were the means of communications.

The terrain is broken and extremely rocky with high amounts of vegetation adjacent to the fireline, thus reducing straight line visibility. Falling snags due to burning of shallow rooted trees are common in and near the fireline.

The Facilitated Analysis Team analyzed all operations that were conducted previous to this accident. The team identified two potential factors that contributed to the accident.

1. The dozer bosses could not talk directly to the dozer operators. While the dozer groups had established protocols for hand signal communications, the terrain and brush had increased the difficulty of communicating clearly in this fashion.
2. When the dozer group met, they had bunched up and when the team began returning to their assigned tasks, there was no formal recognition that work was imminent. DO1 started to move his tractor while DB1 and DO2 were focused on his actions.

Analysis of other Factors Associated with the Accident

1. The Facilitated Analysis Team discussed several environmental factors which had some relationship to the occurrence of this accident. Two other incidents involving snags had occurred prior to this accident, which had raised awareness regarding snag hazard, however, snags and potential snags are so common on the line that it is difficult to see them all while operating a dozer, especially when they are at dozer operator's blind spots.
2. Additionally, communications in this area was patchy making the coordination of all activities more difficult than normal.
3. Additionally, DB1, DB2, DO1 and DO2 were very comfortable with the operation. "Things had been going well, knock on wood" was how the DBs described operations on this day.
4. The span of control for the dozer operations in this area was good. There was one DOZB for each dozer.

6. Summary and Recommendations

This accident had the potential for significant consequences to the well-being of Forest Service employees and contractors and property.

Protocols had been developed to ensure all resources are thinking about and responding to environmental and social factors pertaining to their well-being on the line, including snags, rocky and rough terrain, and complacency.

All personnel involved in the incident had been utilizing proper PPE, developed and used agreed upon signals for operations, had maintained adequate spacing and were using proper techniques during operations.

The Facilitated Learning Analysis evaluation did identify several items that should be evaluated for similar operations in the future.

Recommendations

General Action Items

- ❖ Implement actions to ensure safety of Mechanized operations.
 - Ensure all dozer operators have a means of verbally contacting DOZB. The Operators of these two dozers did not have radio contact with the DOZB, thus making operations a little more difficult. This was corrected by the beginning of the next shift. All dozer operators working on the division had been issued radios the next morning.
 - Ensure spacing between dozer operations and line personnel is maintained and 'bunching-up' does not occur. Continually remind all who work around dozers regarding proper safety techniques/protocols. Even when operations temporarily stop, this spacing should be maintained. When the FLA team visited the accident site two days later, DB1 and DB2 took the appropriate precautions to ensure that our site visit was safe and coordinated with adjacent operations on the Division. Emphasis of proper spacing should be reiterated to all equipment operations on the incident.
 - When dozers or any mechanized equipment (including fallers, engines, etc) are operating near personnel, DOZB (or responsible individuals for the operations) should be in proper position and should ensure the scene is safe prior to allowing operations to continue. When the meeting ended in this situation, it seemed that the group was not quite ready for DO1 to continue the line. The FLA team recommends that when meetings such as this end, there should be more structured direction about how the

operations would begin again, which would include a safety check of the area and having the DOZB in place prior to beginning operations.

- Snags are a hazard on this fire due to shallow root structures in species located around the fire. Develop some ways that will assist line personnel in identifying potential hazard trees and communicate these around the incident.
- When near miss trends begin to develop, or when a serious accident occurs, use various techniques to identify the issues and communicate them to personnel staffing the fire. On this incident, a safety stand down was implemented by the IMT to raise awareness of some of the issues on the incident, including snags, communications, and complacency. As a result of this stand-down some solutions were identified for communications and snag identification.
- Ensure all personnel are aware and adhere to the Accident Communication Procedures that are included in the IAP.

7. Appendices – Collateral Issues

Appendix A Communications

The Communications on this part of the fire had been less than reliable. Ground resources and Communications had spoken several times regarding the spotty nature of communications in this area. The communication technicians have continued to work on this issue, and as of the writing of this Draft Report, there have been no additional issues raised regarding communications at/near this location on this incident.